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Title of Invention : An inorganic light weight aggregate

Application No. : 52-54235

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Specification

1. Title of Invention

An inorganic light weight aggregate.

2. Claims

(1) An inorganic light weight aggregate that is composed of silicate material, such as silicate industrial wastes as its major component; and is combined with alkali silicates, slaked lime, and boric acid as additional components. The highly viscous composition, prepared by kneading the aforementioned ingredients, is pelletized and allowed to foam while being exposed to heat to complete the aggregate.

(2) The inorganic light weight aggregate that is defined by Item (1) of the Claims in which the alkali silicate is water glass.

3. Detailed Description of the Invention

The present invention concerns an inorganic light weight aggregate that is composed of silicate material, such as silicate industrial waste as its major component, combined with an alkali silicate (such as water silicate), slaked lime, and a boric acid solution as additional components. The composition is also combined with silicon resins if necessary. The highly viscous composition formed by kneading these ingredients is pelletized and allowed to foam to complete the aggregate. The purpose of the invention is to offer an inorganic light weight aggregate that can be readily turned into a structural material with a wide range of specific gravities and compressive strengths.

Facing the recent trend for constructing high-rise buildings, there is an increasing need for lighter building materials; and the demand is becoming more urgent for both structural and interior materials. To satisfy these demands, pearlite, coal cinders, and sintered volcanic glass may be used to replace gravel. However for structural material fillers, all are associated with shortcomings, such as poor compressive strength, a high water absorbency rate, and a volume loss due to water absorption when used.

A study was conducted to solve the problems stated above and the present invention, an inorganic light weight aggregate, was completed. Its major component, silicate material, is a type of powdery dust that is expelled from an electric furnace when ferrosilicon is manufactured:

it has a trade name, "Silica Flour" (Joetsu Denro Kogyo). In the past, it was considered to be an industrial waste that posed a problem in its disposal.

This material, composed of 91% of SiO_2, 1% Fe_2O_3, and 1% Al_2O_3, is a white or black fine material with a sandy texture.

In the present invention, this silicate material, the major component, is combined with an alkali silicate such as water silicate, slaked lime, a saturated boric acid solution, and a silicon resin (as needed), as auxiliary components. These ingredients are kneaded to a uniform texture to obtain a highly viscous mixture. The mixture is then pelletized into any desired shape (e.g., spheres, rods, or others) and sintered at high temperature for foaming. Thus an inorganic light weight aggregate with a delicate surface is produced.

Next, the present invention is explained in detail. An alkali silicate such as water glass, slaked lime, and a saturated boric acid solution are mixed to form an evenly kneaded paste that is a highly viscous composition.

If a high degree of waterproofing or water-repellency is desired, a silicon resin is added to this composition. The pasty and highly viscous substance thus prepared is pelletized into any desired form (e.g., spheres or rods) and sintered at 400 to 1,000°C for foaming.

When sintered at high temperature in particular, the moisture in the alkali silicate and boric acid is vaporized and the resultant rise in the internal pressure contributes to foaming. At the high temperature, silicates and boric acid undergo a three-dimensional condensation reaction and become polymerized to form a foamy, inorganic, light weight aggregate, which is associated with a delicate surface, individual foams, low specific gravity with resultant low thermal conductivity, high water-repellency, high compressive strength, and a notable surface hardness.

By merely altering the ratio of the components and sintering temperature, a wide range of specific gravities and compressive strengths may be selected for the inorganic light weight aggregate of the present invention. Furthermore, its water-repellency or waterproofing quality may be markedly improved by adjusting the quantity of the silicon resin to be added.

At pelletization, any desired shape or particle diameter may be selected for each pellet, which constitutes another outstanding advantage over conventional aggregates.

For the main ingredients of the present invention, an inexpensive industrial waste material is used. The auxiliary materials are also inexpensive. For its production, no large

equipment (such as a rotary kiln) is required: it can be manufactured by using a simple apparatus, thus contributing to a notable cost reduction. The boric acid used for the present invention is H_3BO_3; but metaboric acid HBO_2 or pyroboric acid $H_2B_4O_7$ is equally effective.

In place of the industrial waste used as the main component, silicate materials such as white carbon, pearlite, and diatomaceous earth may be used.

[Example 1]

Water glass (sodium silicate No. 1)	100 weight parts
Slaked lime	3 to 10 weight parts
Saturated boric acid solution (12°Bé)	3 to 10 weight parts

To 200 parts of the fluid that contained these ingredients, 100 to 250 parts of Silica Flour (Joetsu Denro Kogyo) were added and kneaded together to form a pasty, highly viscous component with a uniform texture. The preparation was pelletized into particles measuring 2 m/m in diameter and sintered at about 400°C for 15 minutes. The material had the following properties: particle diameter, 5 m/m; specific gravity, 0.2 to 0.3; compressive strength, 7.5 kg/cm^2; and water absorbency, 5.8%.

[Example 2]

Water glass (sodium silicate No. 1)	100 weight parts
Slaked lime	3 to 10 weight parts
Saturated boric acid solution (12°Bé)	3 to 10 weight parts
Silicon resin (Toshiba Silicon TSM 632)	2 weight parts

These components were pelletized into particles measuring 2 m/m in particle diameter, as in Example 1, and sintered in a furnace set at about 400°C for about 10 minutes.

The product had the following properties: particle diameter, 5 m/m; specific gravity, 0.2 to 0.3; compressive strength, 7.4 kg/cm^2; and water absorbency, 2.7%.

Applicant:Gyo Ishikawa

Procedural Modification

Date : August 9, 1978

To : Director, Patent Agency

1. Display of the Matter : 52-54235

2. Title of the Invention : An inorganic light weight aggregate

3. Party Proposing Modification

Relationship with the Matter : Patent Applicant

Address : 1355 Oaza Higashine Ko

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Name : Gyo Ishikawa

4. Date of Modification Order : Automatic

5. Subject of Modification : Specification

6. Content of Modification : See the attached

[Examples] Line 4, page 5 of the Specification is modified as follows.

[Example 1]

Water glass (sodium silicate No. 1)	100 weight parts
Slaked lime	10 weight parts
Saturated boric acid solution	10 weight parts
Silica Flour (Joetsu Denro K.K.)	110 weight parts

These ingredients were mixed and kneaded well to obtain a pasty preparation, which was then placed in a pelletizer to form particles measuring approximately 10 m/m in diameter. They were sintered in a hot furnace at 500°C for 15 minutes to complete a light weight aggregate.

The material was tested and found to have the following properties: mean particle diameter, 26 m/m; specific gravity, 0.46; compressive strength, 23.1 kg/cm^2; and the quantity of alkali that eluted after boiling for 30 minutes, 0.03%.

[Example 2]

Water glass (sodium silicate No. 1)	100 weight parts
Slaked lime	10 weight parts
Saturated boric acid solution	10 weight parts
Silica Flour (Joetsu Denro K.K.)	110 weight parts

Silicon resin (Toshiba Silicon TSM 632) 2 weight parts

These components were turned into pellets as in Example 1 and sintered at 450°C for 15 minutes.

This sintered material had the following properties: mean particle diameter, 26 m/m; specific gravity, 0.48; compressive strength, 22.5 kg/cm^2; and the quantity of alkali that eluted after boiling for 30 minutes, 0.025%.

Patent Applicant: Gyo Ishikawa]